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㉑ DEVICE FOR APPLYING DROSS ADHESION PREVENTIVE FOR PLASMA CUTTING.

㉒ A device for applying a dross adhesion preventive for plasma cutting, which is suitable for executing piercing start on a workpiece and is adapted to realize unmanned and automated plasma cutting operation. A nozzle (4) for injecting the adhesion preventive and a pump (7), both movable along with a plasma torch (1) of the plasma cutting apparatus, are fixed to a reciprocating table (2) having the plasma torch (1) mounted thereon, and the apparatus is provided with piping (8) for supplying compressed air to the nozzle, a solenoid valve (9) for opening or closing the piping, and a control unit (11) for controlling the operation of said pump and solenoid valve. Alternatively the device may be provided with a spray can (34) for the adhesion preventive, an actuator (39) for depressing the valve of this can, a nozzle tube (36), and further a control unit (11) for controlling the operation of the actuator (39).

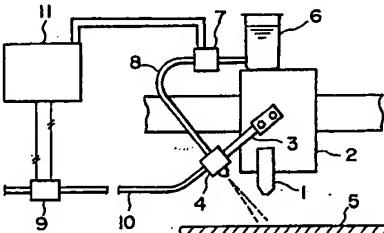


FIG. 1

## ANTI-DROSS-ATTACHMENT AGENT APPLICATION APPARATUS FOR PLASMA CUTTING

Technical Field

This invention relates to an anti-dross-attachment agent application apparatus for use with a plasma cutting machine and, more particularly, to a plasma cutting anti-dross-attachment application apparatus suitable for effecting a piercing start on a member to be cut.

Background Art

Generally, there are two methods for cutting a steel plate into various shapes: one in which cutting is started from an end of the steel plate, and one in which cutting is started from a desired position in the steel plate surface. The latter is a piercing start method in which a through hole is formed in the steel plate at a predetermined position, and in which cutting is started from this through hole (which operation will hereinafter be referred to as "piercing start"). By piercing start, a desired shape in the steel plate surface can be cut out, and plasma cutting is, of course, based on the above two methods.

In the case of cutting a steel plate with a plasma cutting machine by effecting a piercing start, the cut material melted by the plasma torch is blown onto a hole edge portion, attaches to the same, and is further accumulated as a dross. This dross may interfere with the extreme end of the plasma torch to damage the same when the plasma torch is moved, or the melt blown and raised may be attached to the extreme end of the plasma torch so that the plasma jetting is obstructed or that a double arc is caused, resulting in a reduction in cutting quality.

Conventionally, therefore, piercing is performed while the plasma torch is being held in a position such as to be free from the influence of the dross, and cutting is thereafter performed by gradually moving the plasma torch downward to a predetermined position. In this method, however, chips formed by cutting the steel plate are increased. For this reason, a method of previously applying an anti-dross-attachment agent to a piercing start portion of the steel plate has recently been studied.

Ordinarily, an anti-dross-attachment agent is a liquid having very small graphite grains as a main component. Such an anti-dross-attachment agent is applied by a method of manually applying or spraying the anti-dross-attachment agent, a method of mounting an anti-dross-attachment agent application apparatus on the plasma cutting machine, or other methods. In the case of manual application of an anti-dross-attachment agent, however, it is

difficult to uniformly apply the agent, and the application operation is obstructive to the promotion of unmanning or automatization of the plasma cutting operation. In addition, there is no anti-dross-attachment agent application apparatus satisfactory in terms of unmanning or automatizing the plasma cutting operation.

In view of the above-described problems of the conventional methods or apparatus, an object of the present invention is to provide an anti-dross-attachment agent application apparatus for plasma cutting satisfactory in terms of unmanning or automatizing the plasma cutting operation.

Disclosure of Invention

In an arrangement of the present invention, an anti-dross-attachment agent jetting nozzle capable of moving together with a plasma torch of a plasma cutting machine, a tank containing an anti-dross-attachment agent, a piping and a pump for supplying the anti-dross-attachment agent from the tank to the nozzle are attached to a reciprocating table on which the plasma torch is mounted, and there are provided a piping for supplying compressed air to the nozzle, an electromagnetic valve for opening/closing the pipe passage thereof, and a controller for controlling the operations of the pump and the electromagnetic valve.

In another arrangement of the present invention, an anti-dross-attachment agent spray can capable of moving together with a plasma torch of a plasma cutting machine, an actuator for depressing a valve of the spray can, and a nozzle tube for jetting an anti-dross-attachment agent from the spray can to a member to be cut are attached to a reciprocating table on which the plasma torch is mounted, and a controller for controlling the operation of the actuator is provided.

In accordance with these arrangements, the apparatus is provided which sprays the anti-dross-attachment agent to a piercing portion of the member to be cut under the control of the controller, thereby making it possible to spray the anti-dross-attachment agent without any manual operation.

Because an anti-dross-attachment agent contained in a spray can is used, the anti-dross-attachment agent can be resupplied only by changing the spray can. According to the present invention, a cut material melt blown and raised at the time of piercing is blown away by the plasma gas and cannot easily be attached to or accumulated on a hole edge portion, thereby preventing damage of the plasma torch tip, plasma jetting failure, occurrence of a double arc and so on.

Brief Description of Drawings

Fig. 1 is a schematic diagram of the construction of an anti-dross-attachment agent application apparatus for plasma cutting in accordance with a first embodiment of the present invention; Fig. 2 is a diagram of the construction of an example of an application of the first embodiment;

Fig. 3 is a schematic perspective view of a second embodiment of the present invention; and

Fig. 4 is a diagram of the construction of an example of an application of the second embodiment.

Best Mode for Carrying Out the Invention

Anti-dross-attachment agent application apparatuses for plasma cutting in accordance with embodiments of the present invention will be described below in detail with reference to the accompanying drawings.

Fig. 1 is a schematic diagram of the construction of a first embodiment of the present invention in which an anti-dross-attachment agent application apparatus for plasma cutting in accordance with the present invention is attached to a plasma cutting machine in which a plasma cutter is mounted on an X-Y table. A plasma torch 1 is mounted on a reciprocating base 2 which can be moved freely to any position on the X-Y table, and a nozzle 4 is fixed on the reciprocating base 2 with a nozzle fixing bracket 3 interposed therebetween. To maintain the anti-dross-attachment agent spraying distance in a suitable range, the tip of the nozzle 4 is positioned obliquely above the tip of the plasma torch 1 and is fixed at an angle such that when an anti-dross-attachment agent is sprayed to a member 5 which is to be cut, the center of the coating of the anti-dross-attachment agent coincides generally with the center line of the plasma torch 1.

A tank 6 which contains the anti-dross-attachment agent is fixed on the reciprocating base 2, and a hose 8 for supplying the anti-dross-attachment agent from the tank 6 through a pump 7 is connected to the nozzle 4. An electromagnetic valve 9 for opening/closing a compressed air circuit for jetting the anti-dross-attachment agent is provided in an intermediate portion of the compressed air circuit, and a compressed air hose 10 is connected to the nozzle 4. A wiring for the electromagnetic valve 9 is connected to a controller 11 of the plasma cutting anti-dross-agent applying apparatus. The controller 11 operates by being linked to the movement of the reciprocating base 2.

The operation of this apparatus is as described below. The reciprocating base 2 on which the plasma torch 1 is mounted is moved over the member

5 to be cut so that the center of the plasma torch 1 coincides with the piercing start position. Then the controller 11 makes the pump 7 and the electromagnetic valve 9 start operating. The pump 7 supplies the anti-dross-attachment agent in the tank 6 to the nozzle 4, and the electromagnetic valve 9 opens the compressed air circuit to supply compressed air to the nozzle 4. The compressed air opens a valve in the nozzle 4 to spray the member 5 to be cut with the anti-dross-attachment agent at a position right below the plasma torch 1. In this case, the shape of the anti-dross-attachment agent coating is generally elliptical. Next, the operation of the pump 7 is stopped and the electromagnetic valve 9 is closed. Spraying the anti-dross-attachment agent is thereby stopped. After the piercing start portion has been coated with the anti-dross-attachment agent in this manner, a piercing start of the plasma torch is effected.

20 This sequence of operation is repeatedly executed each time a piercing start is performed. However, since it is automatically performed under the control of the controller, there is no need for any manual operation except for inputting the control program into the controller.

25 Fig. 2 shows an example of an application of the first embodiment of the present invention. The nozzle 4 is fixed to the reciprocating base 2 parallel to the plasma torch 1. In this case also, the tip of the nozzle 4 is fixed in a position such as to be located obliquely above the tip of the plasma torch 1.

30 This apparatus sprays the anti-dross-attachment agent based on the control of the controller 11. After the spraying has been completed, the plasma torch 1 is translated with respect to the center of the coating formed by spraying, and a piercing start is thereafter effected.

35 The anti-dross-attachment agent is sprayed perpendicularly to the member 5 to be cut, and the shape of the coating is therefore approximate to a perfect circle.

40 Fig. 3 is a schematic perspective view of a second embodiment of the present invention. Members identical to those shown in Fig. 1 is indicated by the same reference characters and the description for them will not be repeated. A plasma torch 1 is mounted on a reciprocating base 2 which can be moved freely to any position on the X-Y table, and an actuator 39 is fixed on an upper surface of the reciprocating base 2 with a bracket 33 interposed therebetween. The actuator 39 comprises an electromagnetic valve, and has a push pin 38 projecting from its lower surface. The push pin 38 is close to a valve 35 which is an upper portion of an anti-dross-attachment agent spray can 34 on the market. The spray can 34 is fixed below the actuator 33 by a clip 32. One end of a nozzle

tube 36 is connected to an anti-dross-attachment agent jetting port of the spray can 34. To maintain the anti-dross-attachment agent spraying distance in a suitable range, the other end of the nozzle tube 36 is positioned obliquely above the tip of the plasma torch 1 and is fixed by a bracket 3 on the reciprocating base 2 at an angle such that when an anti-dross-attachment agent is sprayed to a member 5 which is to be cut, the center of the coating of the anti-dross-attachment agent coincides generally with the center line of the plasma torch 1.

The operation of this apparatus is as described below. The Z shaft 2 on which the plasma torch 1 is mounted is moved over the member 5 to be cut so that the center of the plasma torch 1 coincides with the piercing start position. Then the controller 11 energizes the electromagnetic valve 39 so that the push pin 38 of this valve depresses the valve 35 on the anti-dross-attachment agent spray can 34. The anti-dross-attachment agent thereby jetted from the spray can 34 is supplied through the nozzle tube 36 and is jetted from the lower end thereof, thereby being sprayed to a position on the member 5 to be cut right below the plasma torch 1. After the spraying of the anti-dross-attachment agent has been completed, the electromagnetic valve 39 is de-energized, the push pin 38 is returned upward, and the valve 35 of the spray can 34 is closed, thereby stopping jetting the anti-dross-attachment agent. After the piercing start portion has been coated with anti-dross-attachment agent in this manner, a piercing start of the plasma torch 1 is effected. The sequence of operation related to the application of the anti-dross-attachment agent described above is repeatedly executed each time a piercing start is performed. However, since it is automatically performed under the control of the controller, there is no need for any manual operation.

Fig. 4 shows an example of an application of the second embodiment of the present invention. The lower end of the nozzle tube 36 is fixed to the reciprocating base 2 parallel to the plasma torch 1. In this case also, the tip of the nozzle tube 36 is fixed in a position such as to be located obliquely above the tip of the plasma torch 1. This apparatus sprays the anti-dross-attachment agent based on the control of the controller 11. After the spraying has been completed, the plasma torch 1 is translated with respect to the center of the coating formed by spraying, and a piercing start is thereafter effected.

In each of the above-described embodiments, the anti-dross-attachment agent application apparatus is attached to a plasma cutting machine in which a plasma cutter is mounted on an X-Y table. However, the present invention is not limited to this. Even in the case of a plasma cutting machine

in which a plasma cutter is mounted on a robot or the like, the anti-dross-attachment agent application apparatus may be attached in the vicinity of the plasma torch to obtain the same effects as the plasma cutting machine in which a plasma cutter is mounted on an X-Y table. An axially moving motor, a pneumatic cylinder, or the like may be used in place of the electromagnetic valve to open/close the valve of the anti-dross-attachment agent spray can. Also, the control portion of the anti-dross-attachment agent application apparatus may be constructed integrally with the plasma torch operation controller, and the anti-dross-attachment agent can be applied to a desired portion other than the piercing position by changing the control program.

#### Industrial Applicability

The present invention is effective as a plasma cutting anti-dross-attachment agent application apparatus satisfactory in terms of unmanning or automatizing the plasma cutting operation, and as an anti-dross-attachment agent application apparatus which is reduced in price and which can be easily utilized.

#### Claims

1. An anti-dross-attachment agent application apparatus for plasma cutting characterized in that an anti-dross-attachment agent jetting nozzle capable of moving together with a plasma torch of a plasma cutting machine, a tank containing an anti-dross-attachment agent, a piping and a pump for supplying the anti-dross-attachment agent from said tank to said nozzle are attached to a reciprocating base on which said plasma torch is mounted, and in comprising a piping for supplying compressed air to said nozzle, an electromagnetic valve for opening/closing the pipe passage thereof, and a controller for controlling the operations of said pump and said electromagnetic valve.
2. An anti-dross-attachment agent application apparatus for plasma cutting characterized in that an anti-dross-attachment agent spray can capable of moving together with a plasma torch of a plasma cutting machine, an actuator for depressing a valve of said spray can, and a nozzle tube for jetting an anti-dross-attachment agent from said spray can to a member to be cut are attached to a reciprocating base on which said plasma torch is mounted, and in comprising a controller for controlling the operation of said actuator.

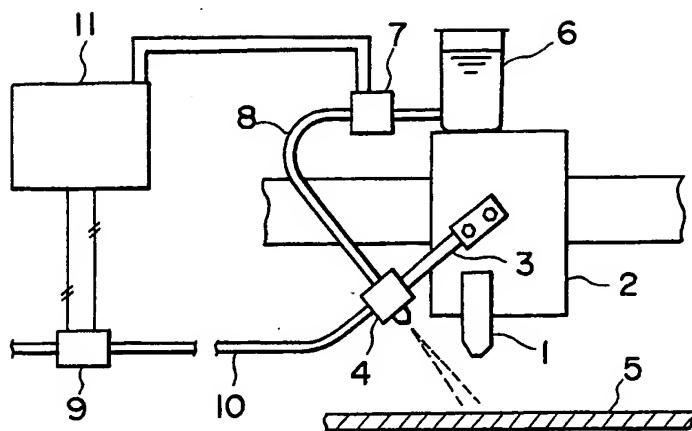


FIG. 1

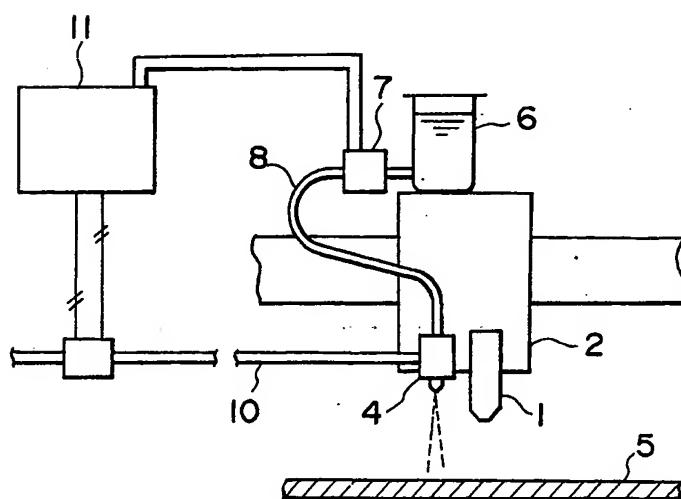


FIG. 2

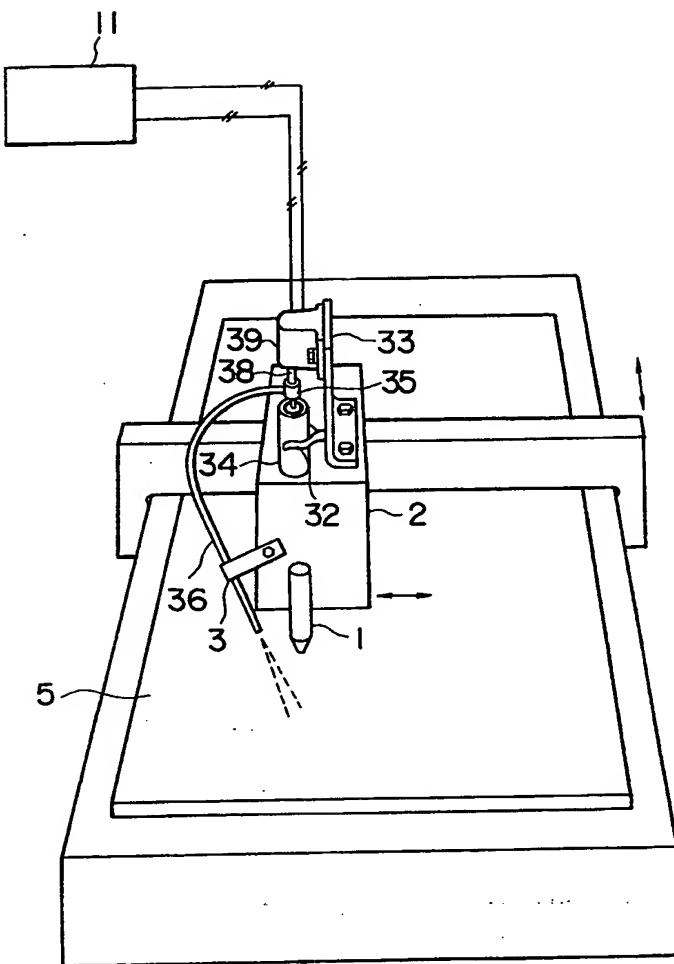


FIG. 3

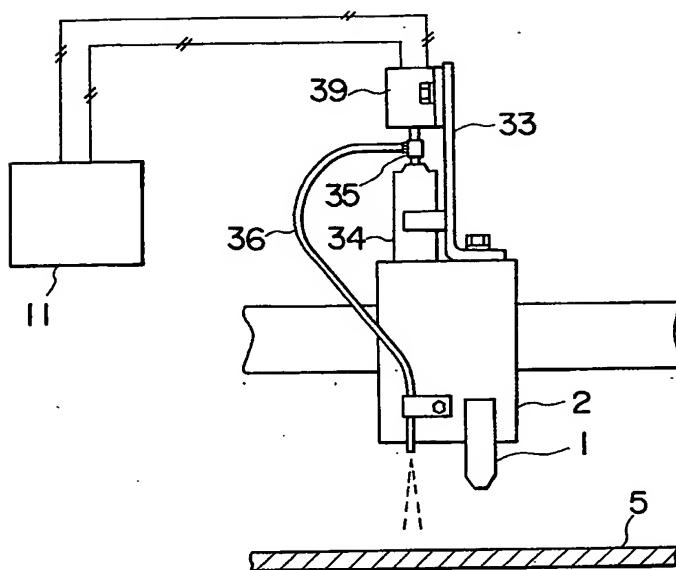


FIG. 4

# INTERNATIONAL SEARCH REPORT

International Application No PCT/JP90/00775

## I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all)<sup>4</sup>

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl<sup>5</sup> B23K10/00

## II. FIELDS SEARCHED

Minimum Documentation Searched<sup>6</sup>

Classification System	Classification Symbols
IPC	B23K10/00, B23K7/10

Documentation Searched other than Minimum Documentation  
to the Extent that such Documents are Included in the Fields Searched<sup>6</sup>

Jitsuyo Shinan Koho 1971 - 1989  
Kokai Jitsuyo Shinan Koho 1971 - 1989

## III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>7</sup>

Category <sup>8</sup>	Citation of Document <sup>9</sup> with indication, where appropriate, of the relevant passages <sup>10</sup>	Relevant to Claim No. <sup>11</sup>
A	JP, A, 54-114457 (Sumitomo Metal Industries, Ltd. and another), 6 September 1979 (06. 09. 79), (Family: none)	1 - 2

<sup>10</sup> Special categories of cited documents:

- <sup>10</sup> "A" document defining the general state of the art which is not considered to be of particular relevance
- <sup>10</sup> "E" earlier document but published on or after the International filing date
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- <sup>10</sup> "T" document referring to an oral disclosure, use, exhibition or other means
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- <sup>11</sup> "T" later document published after the International filing date or priority date and not to conflict with the application but cited to understand the principle or theory underlying the invention
- <sup>11</sup> "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step
- <sup>11</sup> "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- <sup>11</sup> "A" document member of the same patent family

## IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
August 30, 1990 (30. 08. 90)	September 10, 1990 (10. 09. 90)
International Searching Authority Japanese Patent Office	Signature of Authorized Officer